DOCUMENT RESUME

ED 306 086 SE 050 466

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TITLE Implementing an Effective Elementary Program: The Process of Initiating Change and Its Effect on Students' Attitudes.
PUB DATE 89
NOTE 14p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (62nd, San Francisco, CA, March 30-April 1, 1989).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Community Cooperation; *Curriculum Design; Curriculum Development; Curriculum Research; Elementary Education; *Elementary School Science; Science and Society; *Science Course Improvement Projects; *Science Curriculum; Science Instruction; Science Programs; *Student Attitudes; Student Motivation
IDENTIFIERS ScienceQuest

ABSTRACT

In 1987, the Cheshire Public Schools initiated a science curriculum review. Teachers, parents, and students recognized that the existing textbook-based elementary science program was a dismal portrayal of such a dynamic discipline. There was community consensus that reading about science and acquiring scientific vocabulary words were not the same as doing science. A mandate was issued to identify, develop, implement, and evaluate a science curriculum that addressed the current goals in science education. Selected Delta Science Modules were identified as the focal curricular resources around which local curriculum development could be initiated. The first year evaluation supports the fact that "ScienceQuest" was most successful. Between 50% and 88% of the students at any given grade level indicated that science is their first or second favorite subject in school. The nature of the science taught does make a difference. Administrative support and the implementation process are also keys to success. (Author)

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IMPLEMENTING AN EFFECTIVE ELEMENTARY PROGRAM: THE PROCESS OF INITIATING CHANGE AND ITS EFFECT ON STUDENTS' ATTITUDES

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A Poster Session presented at the 62nd Annual Meeting of the National Association for Research in Science Teaching, San Francisco, CA, March 30 - April 1, 1989.

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IMPLEMENTING AN EFFECTIVE ELEMENTARY PROGRAM: THE PROCESS OF INITIATING CHANGE AND ITS EFFECT ON STUDENTS' ATTITUDES

Abstract

In 1987, the Cheshire Public Schools initiated a science curriculum review. Teachers, parents, and students recognized that the existing textbook-based elementary science program was a dismal portrayal of such a dynamic discipline. There was community consensus that reading about science and acquiring scientific vocabulary words was not the same as doing science. A mandate was issued to identify, develop, implement, and evaluate a science curriculum that addressed the current goals in science education. Selected Delta Science Modules were identified as the focal curricular resources around which local curriculum development could be initiated. The first year evaluation supports the fact that ScienceQuest is most successful. Between 50% and 88% of the students at any given grade level indicate that science is their first or second favorite subject in school. The nature of the science taught does make a difference! Administrative support and the implementation process are also keys to success.

Introduction

The 1980s have been exciting and challenging times for educators. Adding to the excitement is the realization that students who entered kindergarten during the Fall of 1988 will be the first high school graduates in the 21st century. Thus, responding to the question, "Are students being provided with the scientific and technological literacy essential for life as productive citizens in the 21st century?" is today's curricular imperative.

In March of 1987, the Cheshire Public Schools (CT) established a K-12 science committee to address the above question. Internal audits revealed a local situation that paralleled the recent national image portrayed by "The Science Report Card..." (NAEP, 1988). The audit revealed that: the elementary program was antiquated in nature, lacking continuity and coordination; the process-approach was not used often; elementary teachers did not have adequate resources to teach science; and, teachers did not feel they possessed an

adequate science knowledge-base and were not comfortable teaching science. Teachers were not familiar with the current goals in science education (NSTA, 1982).

During the next six months the committee developed: a mission statement; a rationale for teaching science; program goals and objectives; a plan for identifying, developing, and piloting curricular materials; a rationale for staff development and program implementation; and, the evaluation component for the first year pilot. The committee decided to begin the curriculum revision process at the elementary level to allow for subsequent curriculum development and continuity at the middle school and high school.

During the 1987-88 academic year, Cheshire's ScienceQuest program was piloted in selected K-6 classrooms. A major goal for the first year was to enhance students' attitudes toward science. Thus, students' attitudes were assessed at the completion of the first year of the pilot. Concomitant goals are to enhance teachers' awareness of the current goals in science education, as well as to enhance their science background so that curriculum development efforts will be relevant and implementation efforts successful. The innovation implementation model utilized in Cheshire for enhancing elementary science programs could be utilized in any school district (see Kyle et al., 1985, 1988a, 1988b for a description of the use of this model in Richardson, recognized as a 1985 Texas state exemplar in the Search for Excellence, where the use of different curricular materials produced similar effects upon student attitudes).

The Process of Initiating Change

There are some common characteristics associated with the process of initiating change and, ultimately, improving schools. Penick and Yager (1983)

report that exemplary programs are designed to be excellent. Such programs do not rely upon routine textbook selections. A considerable amount of time is spent on developing the curriculum, organizing how it will be presented, and encouraging teachers to work as teams. Thus, teachers are involved in staff development activities over several years, including summers.

The nature of staff development activities is so important that Berman and McLaughlin (1978) concluded that the major factor affecting success of staff development efforts related to educational innovations was the administrative support of such endeavors. It is well documented that staff development is an essential component of the curriculum development, implementation, and maintenance process (Fullan, 1982; Hall et al., 1975; Hall & Louchs, 1976; Kyle, Bonnstetter, & Gadsden, 1988a; Kyle & Sedotti, 1987). Additionally, exemplary programs start with, and continue to use, an on-going assessment of teacher, student, and program needs to guide future staff development.

Cheshire's Science Committee recognized that exemplary science programs are the result of effective organization, planning, and staff development initiatives. Thus, they developed a plan to ensure that ScienceQuest: was well articulated and well coordinated; integrated a balance of science processes and concepts; provided students with opportunities to identify and solve problems; enhanced higher cognitive processes and skills; went beyond the mere possession of information to application of the concepts; and, included societal issues.

During the summer of 1987, the science committee identified curricular materials appropriate for pilot testing in grades K-6 during the 1987-88 academic year. Selected Delta Science Modules were identified as the focal curricular resources (see Kyle & Kane, 1988). Additional modules and activities were selected from L.E.A.F., Project Zoo, Cuisenaire, and interactive software

such as Science Toolkit and Voyage of the Mimi. The modules and activities were sequenced to ensure a balance between life science, earth science, and physical science across each grade. The initial piloting of the ScienceQuest program was intended to determine: the success of the modules, activities, and materials and whether they should be maintained in the program as curricular identification, project development and piloting continues; whether modules and activities need to be revised to address district, teacher and/or student needs; as well as, to identify curricular areas for local curriculum development to address effectively the district's mission statement, rationale, goals, and objectives.

Thus, Cheshire's Science Committee sought to ensure that ScienceQuest would meet the standards for excellence cited by Project Synthesis and the National Science Teachers Association (Harms & Yager, 1981; NSTA, 1982). In addition to the curriculum identification, implementation, and evaluation efforts that have been initiated, perhaps the most important component of the entire curriculum revision process is the staff development that teachers received in conjunction with program development and implementation (see Appendix A for a description of the staff development associated with the ScienceQuest project).

Purpose

This study was designed to assess the effect of an elementary science curriculum implementation on student attitudes toward science. The results of this investigation will provide valuable information regarding an implementation intervention in accordance with the Concerns-Based Adoption Model (Hall et al., 1975). Such information will enable districts to focus future staff development and implementation efforts on areas of interest and/or concern to teachers and

students. Thus, the primary focus for this investigation was: How do the attitudes toward science of students who have completed one year of ScienceQuest compare to the attitudes of students in control classes? Further, are any treatment x gender or treatment x grade differences apparent after one year of program implementation?

DESIGN and PROCEDURES

The posttest only control group design was used for this study. The following instrument was administered in May 1988: Preferences and Understandings - Student Version. The Preferences and Understandings questionnaire has been widely used by science education researchers. The validity of the instrument is face validity as reported by NAEP (1978). The alpha internal consistency reliability coefficient for the student version is 0.82 as reported by Kyle, Bonnstetter, and Gadsden (1988a).

The questionnaire was administered to all students in ScienceQuest pilot classrooms in grades 2 through 6 (n = 260; 54% male and 46% female) and a random sample of two control classrooms per grades level from non-pilot schools in the district (n = 258; 48% male and 52% female). Data were analyzed using an analysis of variance.

Results

The results of the ANOVA reveal statistically significant attitudinal differences between students in the ScienceQuest program and students in control classes as measured by the Preferences and Understandings: Total Score (see Table I). Thus, students in the ScienceQuest program possess enhanced attitudes toward science, when compared to students in control classes, after one year of

the implementation process. The analysis reveals no significant differences for the treatment by gender total score ANOVA. Thus, there is no evidence of attitudinal differences between males and females after one year of ScienceQuest. This finding contrasts with national norms, which traditionally find females to possess less positive attitudes toward science. The results show significant interaction effects for the treatment by grade total score ANOVA. Thus, while there is a differential impact upon students' attitudes depending upon the grade level, frequency data analysis (Kyle & Bonnstetter, 1988) reveals that ScienceQuest students across all grade levels consistently show more positive attitudes toward science when compared to students in control classes.

TABLE I

ANALYSIS OF VARIANCE FOR
PREFERENCES AND UNDERSTANDINGS: TOTAL SCORE

Source	DF	MS	F	SIG
Treatment				
Between Groups	1	3967.8	33.8	.000*
Interaction				
Group x Gender	1	0.65	0.006	.941
Group x Grade	4	359.2	3.3	.011*

*$p < 0.05$

Discussion

After only one year of the pilot project, ScienceQuest students possess significantly enhanced attitudes toward science, when compared to their counterparts in control classrooms, as measured by the Preferences and Understandings attitude questionnaire. The data support the fact that elementary students have a preference for inquiry-oriented, process-approach science.

Frequency item analysis reveals that over 60% of ScienceQuest students selected science as their first or second favorite subject in school. Only 35% of the control students indicated similar preferences. This dichotomy is further dramatized by the fact that only 6% of ScienceQuest students selected science as their least favorite subject in school compared to 15% of the control students.

Research indicates that as students progress through school that their attitudes toward science decrease and they appear to be unenthusiastic about the value and personal relevance of their science learning (Hueftle, Rakow, & Welch, 1983; NAEP, 1978, 1988). Students in the control group appear to reflect the national trend when the results for the combined first or second favorite subject are viewed. Forty-one percent of the control students in grades 2 and 3 select science as their first or second favorite subject. This percentage drops to the 30% range by the time students reach 5th and 6th grade. Similarly, 2% of 2nd and 3rd grade control group students select science as their least favorite subject, while 20% - 28% of 4th, 5th or 6th grade control group students make such claims. However, over 50% of the ScienceQuest students at each grade level selected science as their first or second favorite subject. The percentage peaks at 3rd and 4th grade with 83% and 88% of the students

making such claims. Obviously, when 50% to 88% of the students at any grade level, and 63% of the students across all grades, have such positive images of a program, it is a tremendous success!

The data also reveal that students in ScienceQuest classes wish they had more time for science (59% vs. 40%); are more likely to recognize that the science they study is useful in their daily lives (74% vs. 68%) and will be useful to them in the future (68% vs. 59%); view their science experiences as fun (84% vs. 62%), interesting (88% vs. 70%), and exciting (71% vs. 52%), all while fostering a feeling of success (60% vs. 49%) and curiosity (71% vs. 67%).

The results presented herein contrast sharply with national norms (NAEP, 1978, 1988). The positive attitudes of students in the ScienceQuest program can be attributed to the nature of the program, in conjunction with the staff development that teachers received to implement an effective science curriculum. The nature of the science taught does make a difference! In addition, when teachers are provided with appropriate staff development, they are able to portray an image of science that is fun, exciting, and interesting. Many teachers are enjoying the teaching of science as it should be for the first time in their careers, and they have the support required to do so!

References

Fullan, M. (1982). The meaning of educational change. New York: Teachers College Press, Columbia University.

Hall, G. E., & Louchs, S. F. (1976). A developmental model for determining whether or not a treatment really is implemented. Austin, TX: The University of Texas at Austin, Research and Development Center for Teacher Education.

Hall, G. E., Louchs, S. F., Rutherford, W. L., & Newlove, B. W. (1975). Levels of use of the innovations: A framework for analyzing innovative adaptations. Journal of Teacher Education, 26(1), 52-56.

Harms, N. C., & Yager, R. E. (Eds.) (1981). What research says to the science teacher, Vol. 3. Washington, DC: National Science Teachers Association.

Hueftle, S. J., Rakow, S. J., & Welch, W. W. (1983). Images of science: A summary of results from the 1981-82 National assessment in science. Minneapolis, MN: University of Minnesota, Minnesota Research and Evaluation Center.

Kyle, W. C., Jr. (1984). Curriculum development projects of the 1960s. In David Holdzkom & Pamela B. Lutz (Eds.), Research within reach: Science education (pp. 3-24). Washington, DC: National Science Teachers Association.

Kyle, W. C., Jr., & Bonnstetter, R. J. (1988, October). ScienceQuest: Elements of success, challenges for the future. A report submitted to Cheshire Public Schools, Department of Education. (Available from either author)

Kyle, W. C., Jr., Bonnstetter, R. J., & Gadsden, T., Jr. (1988a). An implementation study: An analysis of elementary students' and teachers' attitudes toward science in process-approach vs. traditional science classes. Journal of Research in Science Teaching, 25, 103-120.

Kyle, W. C., Jr., Bonnstetter, R. J., Gadsden, T., Jr., & Shymansky, J. A. (1988b). What research says...About hands-on science. Science & Children, 25(7), 39-40, 52.

Kyle, W. C., Jr., Bonnstetter, R. J., McCloskey, S., & Fults, B. A. (1985). Science through discovery: Students love it. Science & Children, 23(2), 39-41.

Kyle, W. C., Jr., & Kane, M. (1988). What research says...About the new science curricula: Delta Education's Delta Science Modules. Science & Children, 25(8), 39.

Kyle, W. C., Jr., & Sedotti, M. A. (1987). The evaluation of staff development: A process, not an event. In Barbara S. Spector (Ed.), 1986 AETS Yearbook, Guide to inservice teacher education: Research into practice (pp. 101-118). Columbus, OH: ERIC/SMEAC.

National Assessment of Educational Progress (NAEP). (1978). Science: Third assessment (1976-77). Denver, CO: Author.

National Assessment of Educational Progress (NAEP). (1988). The science report card: Elements of risk and recovery. Princeton, NJ: Educational Testing Service.

National Science Teachers Association (NSTA). (1982). Science - Technology - Society: Science education for the 1980s (A position statement). Washington, DC: Author.

Penick, J. E. (Ed.) (1983). Focus on excellence: Elementary science, Vol. 1, No. 2. Washington, DC: National Science Teachers Association.

Penick, J. E., & Bame, M. (Eds.) (1988). Focus on excellence: Elementary science revisited, Vol. 4, No. 3. Washington, DC: National Science Teachers Association.

Penick, J. E., & Yager, R. E. (1983). The search for excellence in science education. Phi Delta Kappan, 64, 621-623.

Appendix A

ScienceQuest Staff Development

Each month from September to November and January to May, there were grade level meetings for the pilot teachers. The staff development sessions provided pilot teachers the opportunity to:

* delve into the history and philosophy of science education in order to gain an appreciation of the goals associated with hands-on, process-approach science at the elementary school level.

* study the characteristics of the curriculum development initiatives of the 1960s and 1970s, as well as attributes of their success as measured by student performance.

* investigate the current goals identified for science education at the national level. Instructional strategies to address the goals in elementary science classrooms were also discussed and modeled.

* participate as active learners in the activities associated with each module that they would instruct in their classroom. During these model instructional sessions, teachers were able to make preliminary revisions or modifications to the organization of the modules to ensure effective implementation. At the completion of these sessions, teachers ordered any additional equipment or resources that they needed to effectively instruct the module.

* receive content updating to enhance their science background in areas correlating with eventual instructional responsibilities. The content updating was provided as needed and requested by the pilot teachers.

* share information regarding the nature of curriculum implementation, the need for revision/modification of specific modules, and modes to resolve any difficulties that may have arisen. Teachers prepared and submitted written evaluations for each module. The evaluation included, but was not limited to, the pilot teacher's recommendation to keep or delete the module from the curriculum, as well as a detailed report of any adaptations made to the module to achieve the desired outcomes with their students.

During the summer of 1988, pilot teachers worked with the science committee to continue the process of identifying curricular materials, revising modules based upon pilot teacher evaluation, identifying materials and equipment necessary for instruction, and initiating the process of local curriculum development. A goal for second year pilot teachers is to develop a strand of curricular materials/activities with a focus on science, technology, and societal issues and/or applications of scientific concepts that can be integrated into the curriculum.

The second year of the ScienceQuest implementation (1988-89) has approximately 40 new teachers piloting the program and participating in the sequence of activities associated with the first year staff development plan. In addition, work related to the development of a criterion referenced evaluation system to assess students' mastery of science processes and concepts will begin during the 1988-89 academic year. The formal evaluation of students' attitudes will be continued with an assessment of students in first and second year ScienceQuest classes compared to control classes (May 1989). A formal assessment of student achievement will be a part of the second year pilot plan, as well as an assessment of teachers concerns and levels of use of the program in compliance with the Concerns-Based Adoption Model. The implementation efforts undertaken, and planned for the future, will ensure that Cheshire's ScienceQuest curriculum will be a dynamic, rather that static, elementary science program.